



Designation: D6780/D6780M – 19

Standard Test Methods for Water Content and Density of Soil In situ by Time Domain Reflectometry (TDR)¹

This standard is issued under the fixed designation D6780/D6780M; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reapproval.

1. Scope*

1.1 This test method may be used to determine the water content of soils and the density of soils in place using Time Domain Reflectometry.

1.2 This test method applies to soils that have 30 % or less by weight of their particles retained on the 19.0-mm [$\frac{3}{4}$ -in.] sieve.

1.3 This test method is suitable for use as a means of acceptance for compacted fill or embankments.

1.4 This test method is not appropriate for frozen soils or soils at temperatures over 40°C [100°F] and may not be suitable for organic soils, highly plastic soils, or extremely dense soils.

1.5 All observed and calculated values shall conform to the guidelines for significant digits and rounding established in Practice D6026.

1.5.1 The method used to specify how data are collected, calculated, or recorded in this standard is not directly related to the accuracy to which the data can be applied in design or other uses, or both. How one applies the results obtained using this standard is beyond its scope.²

1.6 Two alternative procedures are provided to determine the water content and the density of soil in situ:

1.6.1 *Procedure A* involves two tests in the field, an in situ test and a test in a mold containing material excavated from the in situ test location. The apparent dielectric constant is determined in both tests.

1.6.2 *Procedure B* involves only an in situ test by incorporating the first voltage drop and long term voltage (V_I and V_f) in addition to the apparent dielectric constant. While the bulk

electrical conductivity can be determined from these measurements, it is not needed for the determination of water content and density.

1.7 *Units*—The values stated in either SI units or inch-pound units are to be regarded separately as standard. The values stated in each system may not be exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in non-conformance with the standard. For additional information consult SI10.

1.8 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.9 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards*:³

D653 Terminology Relating to Soil, Rock, and Contained Fluids

D698 Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³))

D1557 Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN-m/m³))

D2216 Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass

D2487 Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)

D3740 Practice for Minimum Requirements for Agencies

¹ This test method is under the jurisdiction of ASTM Committee D18 on Soil and Rock and is the direct responsibility of Subcommittee D18.08 on Special and Construction Control Tests.

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² “The Water Content and Density of Soil In situ by Time Domain Reflectometry apparatus and procedures are covered by a patent. If you are aware of an alternative(s) to the patented item, please attach to your ballot return a description of the alternatives. All suggestions will be considered by the committee.”

³ For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard’s Document Summary page on the ASTM website.

*A Summary of Changes section appears at the end of this standard